

CLAIM AMENDMENT

Listing of Claims:

- 1-12. (Canceled)
13. (Currently amended) An apparatus comprising:
a single multiplexing network element including,
a plurality of slots to be coupled to optical fiber of multiple TDM rings
through line cards installed in said slots, ~~wherein one of said
multiple TDM rings is a TDM access ring coupled to customer
premise equipment,~~
a multiple ring unit to simultaneously support multiple TDM rings, and
a full TDM cross-connect coupled to each of said slots with the same
amount of high-speed bandwidth, wherein said full cross-connect
is programmable to switch time slots between the different TDM
rings, wherein
a first number of the line cards in said slots are to be coupled to
customer premise equipment to form TDM access rings,
a second number of the line cards in said slots are to be coupled to
network elements to form collector rings, and
wherein the first number is larger than the second number.
14. (Original) The apparatus of claim 13, wherein a line card with multiple ports can
be installed in any one of said plurality of slots.
15. (Previously presented) The apparatus of claim 13, wherein the amount of high-
speed bandwidth is OC-48.

16. (Original) The apparatus of claim 13, wherein said plurality of slots number greater than 6.
17. (Previously Presented) The apparatus of claim 13, wherein said multiple ring unit includes:
- a protection group manager structure of which an instance is formed for each ring provisioned in said single network element, said protection group manager structure including,
 - a ring ID to distinguish between the different rings simultaneously provisioned in said single network element, and
 - a ring map.
18. (Original) The apparatus of claim 17, wherein said protection group manager structure further includes:
- an east and west protection unit to identify ones of said plurality of slots coupled to a given TDM ring, as well as ports on line cards inserted in those slots coupled to the given TDM ring.
19. (Original) The apparatus of claim 13, wherein said multiple ring unit includes:
- a line card manager structure of which an instance is created for each line card inserted in said plurality of slots;
 - a port manager structure of which an instance is created for each port of each line card inserted in said plurality of slots;
 - a multi-ring manager structure to store identification information regarding each ring provisioned in said single network element;
 - a protection group manager structure of which an instance is created for each ring provisioned in said single network element; and

a network management system interface to be coupled to instances of said line card manager, said port manager, said multi-ring manager, and said protection group manager structures.

20. (Original) The apparatus of claim 19, wherein said protection group manager structure includes:

a ring ID to distinguish between the different rings simultaneously provisioned in said single network element, and
a ring map.

21. (Currently amended) An apparatus comprising:

a network element in a hubbed network office, said network element including,
a plurality of line cards, wherein optical fiber from two different rings is directly coupled to said network element through one or more of said plurality of line cards, wherein one of said rings includes other network elements which are coupled to customer premise equipment by TDM access rings of which that customer premise equipment is a part;

a multiple ring unit to simultaneously support the two different rings, and
a full TDM cross-connect coupled to each of said line cards with the same amount of high-speed bandwidth, wherein said full cross-connect is programmable on an STS-1 basis and is programmed to switch certain time slots between the two different rings.

22. (Original) The apparatus of claim 21, wherein one of said rings is a TDM collector ring.

23. (Original) The apparatus of claim 22, wherein another of said rings is a TDM collector ring.
24. (Original) The apparatus of claim 22, wherein another of said rings is a WDM or DWDM ring.
25. (Previously presented) The apparatus of claim 21, wherein said two rings are a metro collector ring and a metro core ring.
- 26-27. (Cancelled)
28. (Original) The apparatus of claim 21, wherein at least one of said plurality of line cards includes multiple ports.
29. (Original) The apparatus of claim 21, wherein the amount of high-speed bandwidth is OC-48.
30. (Original) The apparatus of claim 21, wherein said plurality of line cards number greater than 6.
31. (Original) The apparatus of claim 21, wherein said multiple ring unit includes:
a protection group manager for each of said rings, each of said protection group managers including,
a ring ID to distinguish between the two different rings, and
a ring map.

32. (Original) The apparatus of claim 31, wherein each of said protection group managers further includes:

an east and west protection unit to identify those of said plurality of line cards coupled to that protection group manager's one of the two different rings, as well as the ports on those line cards coupled to that ring.

33. (Original) The apparatus of claim 21, wherein said multiple ring unit includes:

a line card manager for each of said plurality of line cards;
a port manager for each port on said plurality of line cards;
a multi-ring manager to store identification information regarding the two different rings;
a protection group manager for each of the two different rings; and
a network management system interface coupled to each of said line card managers, said port managers, said multi-ring manager, and said protection group managers.

34. (Original) The apparatus of claim 33, wherein each of said protection group managers includes:

a ring ID to distinguish between the two different rings, and
a ring map.

35. (Previously presented) An apparatus comprising:

a single network element including,
a plurality of multi-purpose slots into which are inserted line cards, certain ones of said multi-purpose slots acting as aggregation interfaces are coupled to a ring, and certain ones of said multi-purpose slots

acting as access interfaces are coupled to customer premise equipment with TDM access rings; and
a full TDM cross-connect coupled to each of said plurality of multi-purpose slots with the same amount of bandwidth, wherein the sum of the bandwidth to the access interfaces is greater than the sum of the bandwidth to the aggregation interfaces, and wherein said full TDM cross-connect is programmed to groom traffic on said access interfaces to said aggregation interfaces.

36. (Original) The apparatus of claim 35, wherein one of said access interfaces includes a line card with a plurality of ports.
37. (Previously presented) The apparatus of claim 35, wherein the bandwidth of said plurality of TDM access rings is greater than the bandwidth of said ring.
38. (Previously presented) The apparatus of claim 37, wherein the actual traffic on said plurality of TDM access rings is less than the bandwidth of said ring.
39. (Original) The apparatus of claim 37, wherein said single network element further includes:
a protection group manager for each of said rings, each of said protection group managers including,
a ring ID to distinguish between the different rings, and
a ring map.
40. (Original) The apparatus of claim 39, wherein each of said protection group managers further includes:

an east and west protection unit to identify those of said line cards that are coupled to that protection group manager's ring, as well as the ports on those line cards coupled to that ring.

41. (Original) The apparatus of claim 37, wherein said single network element further includes:

- a line card manager for each line card in said plurality of multi-purpose slots;
- a port manager for each port of said line cards;
- a multi-ring manager to store identification information regarding the two different rings;
- a protection group manager for each of the rings; and
- a network management system interface coupled to each of said line card managers, said port managers, said multi-ring manager, and said protection group managers.

42. (Original) The apparatus of claim 41, wherein each of said protection group managers includes:

- a ring ID to distinguish between the rings, and
- a ring map.

43. (Previously presented) The apparatus of claim 35, said ring is a WDM or DWDM ring.

44. (Previously presented) The apparatus of claim 35, said ring is a TDM collector ring.

45. (Original) The apparatus of claim 35, wherein the same amount of bandwidth is OC-48.

46. (Original) The apparatus of claim 35, wherein said plurality of multi-purpose slots number greater than 6.

47. (Previously presented) An apparatus comprising:
a single network element including,
a set of one or more line cards coupled to one or more network trunks,
a plurality of line cards coupled to a plurality of sets of one or more pieces
of customer premises equipment,
a full cross connect coupled to each of said line cards , wherein the sum of
the bandwidth between said full cross connect and said plurality of
line cards is greater than the sum of the bandwidth between said
full cross connect and the set of line cards, wherein the bandwidth
from said full cross-connect to at least certain ones of said plurality
of line cards is only partially used, and wherein said full cross-
connect multiplexes the used bandwidth of said plurality of line
cards to said set of line cards.

48. (Original) The apparatus of claim 47, wherein one of said plurality of line cards has a plurality of ports.

49. (Original) The apparatus of claim 48, wherein one of said plurality of sets of one or more pieces of customer premises equipment is coupled to said single network element using a TDM access ring.

50. (Original) The apparatus of claim 48, wherein said plurality of line cards are coupled to said customer premise equipment with TDM access rings, wherein said network trunk is a TDM collector ring, and wherein the sum of the bandwidth of said plurality of TDM access rings is greater than the bandwidth of said TDM collector ring.

51. (Original) The apparatus of claim 50, wherein said single network element further includes:

- a protection group manager for each of said rings, each of said protection group managers including,
- a ring ID to distinguish between the different rings, and
- a ring map.

52. (Original) The apparatus of claim 51, wherein each of said protection group managers further includes:

- an east and west protection unit to identify those of said line cards that are coupled to that protection group manager's ring, as well as the ports on those line cards coupled to that ring.

53. (Original) The apparatus of claim 50, wherein said single network element further includes:

- a line card manager for each of said line cards;
- a port manager for each port on said line cards;
- a multi-ring manager to store identification information regarding the different rings;
- a protection group manager for each of the rings; and

a network management system interface coupled to each of said line card managers, said port managers, said multi-ring manager, and said protection group managers.

54. (Original) The apparatus of claim 53, wherein each of said protection group managers includes:

a ring ID to distinguish between the rings, and
a ring map.

55. (Original) The apparatus of claim 48, said network trunk is a WDM or DWDM ring.

56. (Original) The apparatus of claim 55, wherein said single network element further includes:

a multiple ring unit that allows for multiple TDM rings to be coupled to said single network element simultaneous.

57. (Original) The apparatus of claim 56, wherein said plurality of line cards are coupled to said customer premise equipment through multiple TDM access rings.

58. (Original) The apparatus of claim 48, wherein the same bandwidth is OC-48.

59. (Original) The apparatus of claim 48, wherein said full cross-connect is coupled to each of said line cards with the same amount of high-speed bandwidth.

60. (Currently amended) An apparatus comprising:
a first and second network element each including,

a full TDM cross-connect coupled to every line card slot in said network element with the same amount of bandwidth connection, wherein said full TDM cross-connect is programmable on an STS-1 basis, a multiple ring unit simultaneously supporting multiple TDM rings, and a plurality of TDM access rings coupled to line cards inserted in said line card slots of said first network element to connect different pieces of customer premise equipment;

said first and second network elements coupled to a first TDM collector ring through line cards inserted in said line card slots, wherein the sum of the bandwidth of the plurality of TDM access rings in the first network element is greater than the bandwidth of the first TDM collector ring;

a second ring coupled to line cards inserted in said line card slots of said second network element.

61. (Original) The apparatus of claim 60, wherein said second ring is another TDM collector ring.

62. (Original) The apparatus of claim 61, wherein said second ring is a WDM or DWDM ring.

63. (Currently amended) The apparatus of claim 62, ~~wherein the sum of the bandwidth of the TDM access rings is greater than the bandwidth of the first TDM collector ring, and~~ wherein said full TDM cross-connect in said first network element is programmed to groom traffic on said plurality of TDM access rings to said first TDM collector ring.

64. (Original) The apparatus of claim 60, wherein each of said first and second network elements further includes:

a protection group manager for each of ring provisioned in that network element,
each of said protection group managers including,
a ring ID to distinguish between the different rings provision in that
network element, and
a ring map.

65. (Original) The apparatus of claim 64, wherein each of said protection group managers further includes:

an east and west protection unit to identify those of said line cards in that network element that are coupled to that protection group manager's ring, as well as the ports on those line cards coupled to that ring.

66. (Original) The apparatus of claim 63, wherein each of said first and second network elements further includes:

a line card manager for each of said line cards in that network element;
a port manager for each port on said line cards in that network element;
a multi-ring manager to store identification information regarding the different rings provisioned in that network element;
a protection group manager for each of the rings provisioned in that network element; and
a network management system interface coupled to each of said line card managers, said port managers, said multi-ring manager, and said protection group managers.

67. (Original) The apparatus of claim 66, wherein each of said protection group managers includes:

a ring ID to distinguish between the rings provisioned in that network element,
and
a ring map.

68 – 81 (Cancelled)